

11 March 1964

STATINTL

[REDACTED]

Consulting Contract (Labor Hours, Time and Material) for John.

Analyze maintenance requirements and develop "Trouble/Failure Reporting System". Identify equipment characteristics, review manufacturers' instructions, determine critical aspects (alignment, calibration, etc.), and establish report form and procedure for acquiring failure and repair data. Establish failure (tolerance) definitions for equipment. The TFR program will provide data necessary to:

1. Determine preventive maintenance requirements,
2. Develop maintenance schedule,
3. Develop future design requirements, and
4. Improve inventory control (spare parts).

The maintenance program will lead to:

1. Improved quality and effectiveness per unit cost, and
2. Minimum unscheduled down time.

Cost

Labor

Transportation

Per Diem

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ILLEGIB

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Distribution:

Orig & 1

1

2 - F&DS/DB

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DEVELOPMENT OF A MAINTENANCE PROGRAM AND A TROUBLE AND FAILURE REPORTING SYSTEM

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STATEMENT OF WORK

[REDACTED] will provide the professional services necessary to guide and direct the development of a maintenance management program and the design of a trouble and failure reporting system. Technical assistance will be provided to assemble necessary data, determine performance characteristics and requirements, and develop the detailed procedures for proper maintenance and reporting of maintenance activities. In-house participation will be utilized to the fullest extent possible in analyzing requirements and specifying procedures. Our services will include the preparation of the necessary documentation and participation in implementing systems and procedures to the extent desired.

PLANNED APPROACH

Development of the maintenance program will be the first priority task although some aspects of the TFR system may be pursued at the same time. Certain tasks, which will utilize the in-house capability to good advantage, should be undertaken as soon as possible. By the time access to the equipment is necessary, much of the preliminary familiarization and analysis will have been completed and the ground work laid for the maintenance schedules and procedures.

Maintenance Program

Maintenance Principles

1. The objectives of the maintenance program will be to improve the quality of output and the availability of the equipment. The schedule and procedures which are developed will be aimed at reducing "catastrophic" failures, extending the life of the equipment, and detecting deterioration. The first two are fairly obvious. The latter is more subtle. Quality depends on such things as alignment, calibration, and contrast, which are often functions of some component subject to

gradual change. Unless adequate methods of check-out are rigorously and regularly applied quality will gradually deteriorate.

2. The Maintenance effort should be the least amount consistent with providing a desired level of equipment performance. "Least" means the smallest number of man-hours. "Desired" level of performance will have to be defined for each equipment item or type of item in terms of operational need (essentiality), cost of malfunction (failure or degraded performance), and extent to which the function may be performed by other equipment. Obviously any effort which does not improve quality or availability is to be avoided. In addition, this calls for simple and quick methods of checking and isolating faults, as well as calibration and alignment. Consideration must also be given to on-line repair vs. replacement.

3. Preventive maintenance should disrupt production operations as little as possible. Off-hours should be used to the greatest extent possible. However, if this is not possible a trade-off between scheduled and unscheduled down-time must be considered.

4. Preventive maintenance should be routinely scheduled. Without a planned approach malfunctions may go unnoticed and certain types of failures which could be avoided will cause unscheduled down-time. Work also must be assigned systematically or will tend to be put-off in favor of other attractions. A schedule is also essential to most efficient use of time. Scheduling is essentially an allocation problem to which the techniques of operations research can be applied.

5. Maintenance instructions must be readily understood and implimentable by the user under the prevailing conditions. Simple step-by-step instructions are most effective. They have to be written with a specific user in mind. For instance, a different approach may be needed for operational check-out, calibration, etc. than for a more exacting and thorough maintenance examination.

6. Training in the conduct of the maintenance routines are necessary. Instruction books alone are not sufficient. For efficient reliable maintenance, experience on the equipment is required. In some instances "factory" training may be desirable.

7. Maintenance management should be the province of a single individual provided the tools, authority, etc. to fulfill the responsibility. To do the job effectively, an "office" with the necessary support of the rest of the organization is necessary. This "office" has custody of the necessary test gear, tools, etc. It is also the focal point for information on reliability, maintenance, and the trouble and failure reporting system.

Outline of Tasks

The maintenance program will be developed from an analysis of the equipment characteristics, functions, and use environment. Specific tasks to be accomplished in the course of the study include:

1. List equipment,
2. Obtain and review manufacturer's operating and repair manuals, instructions, or other literature,
3. Observe operating procedures,
4. Determine usage factors,
5. Determine criticality of output (effects of deterioration),
6. Separate equipment into groups according to whether output constant or changing with time,
7. Identify equipments requiring scheduled maintenance,
8. Develop test and calibration procedures,
9. Define "failure" or operating tolerances,
10. Determine frequency of maintenance,
11. Develop procedures,
12. Develop schedules,

13. Prepare documentation, and

14. Provide or obtain training.

Trouble and Failure Reporting System

The objectives of a TFR system are to:

1. determine maintenance requirements,
2. influence future design requirements,
3. improve control of spare parts inventory, and
4. provide for better production scheduling.

The success of a TFR system depends mainly on obtaining the required information without overly burdening those who have to make it work. The weak link is usually at the source of the data on which the whole system depends. If requirements are too complex, forms bulky, or the organizational atmosphere indifferent, those responsible for initiating reports are inclined to shirk their duties. A major effort then will be devoted to the questions concerning the who, what, and how of reporting.

In general terms the design of the TFR system will be concerned with determining in the light of the particular organizational and operational characteristics:

1. Who should report? Will all maintenance, calibration, alignment, test, and part replacement be performed by designated maintenance personnel or will some functions be performed by the operators?
2. What should be reported? Usually anything connected with repair, replacement, adjustment, or inadequacies of design, quality, and documentation.
3. How should it be reported? A simple, easy to use preprinted form containing all necessary instructions is desirable.
4. Where to report? The distribution of reports should also be left simple. Usually three copies would suffice, one to be retained by "maintenance", one to go to data processing, and one to accompany any item removed for repair.

5. How to process data? Hand or machine methods will depend on the quantity of reports generated and the various ways in which it is desired to analyze data. As a minimum failures or trouble should be listed by type, equipment, and component. Data on total down-time, unscheduled down-time and frequency of failure are useful.
6. How to implement corrective action? Data collection is only part of the story. Summary reports indicating trouble spots and trends must be provided to management levels at which action may be initiated.
7. What is included in system? Should test and laboratory equipment be included with the production items?

The proposed technical assistance will specify the information on organization and operations which is needed, and work with your personnel in evolving the concept and outline of the system. Specific forms and procedures will be devised for operation of the system and assistance provided in the implementation.